Implementing the Open Water Information Architecture (OWIA)

Theme I: Bridging-The-Gap Between Research and Operations

Topic A: Water Balance Automation

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SCRIPPS INSTITUTION OF OCEANOGRAPHY
UC San Diego

Outline

1 What Are We Doing?

2 How Are We Doing IT?
- OWIA Concept of Operations
- OWIA-Node Functional Components
- Integrated Schedule
- Implementing the OWIA
- Theme I Topic A: Water Balance Automation (Use Case)

3 Results
- Tables (Programmable)
- Application Example: WaDE Interoperability with Traceability & Reproducibility
- Figures (Programmable)

4 Summary

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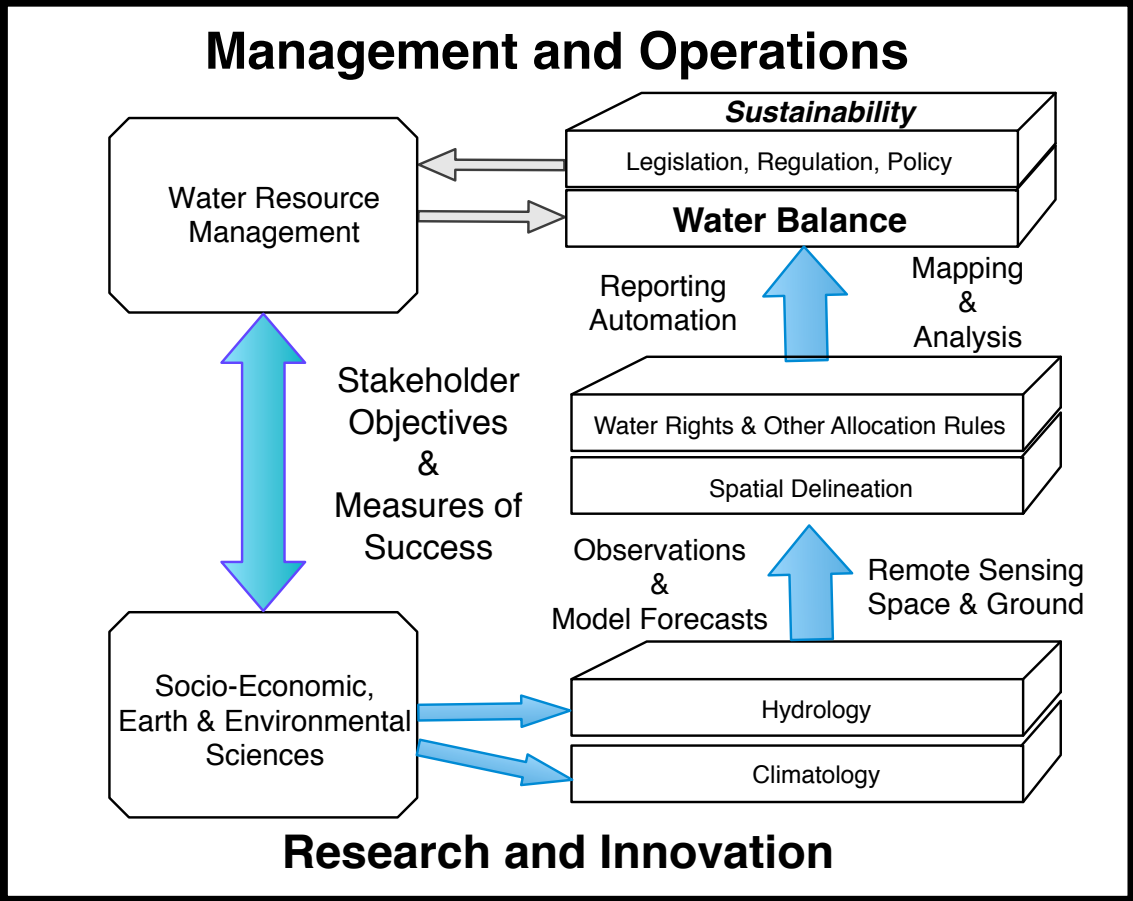
What Are We Doing?

Building a decision-support system to improve water resource management and advance hydrologic research



- Mobilizing the best data in an on-going way
- Ensuring that it is open and sustainable
- Providing for technology transfer from research to operations
- Controlling development and operational risk (cost, schedule, technical)

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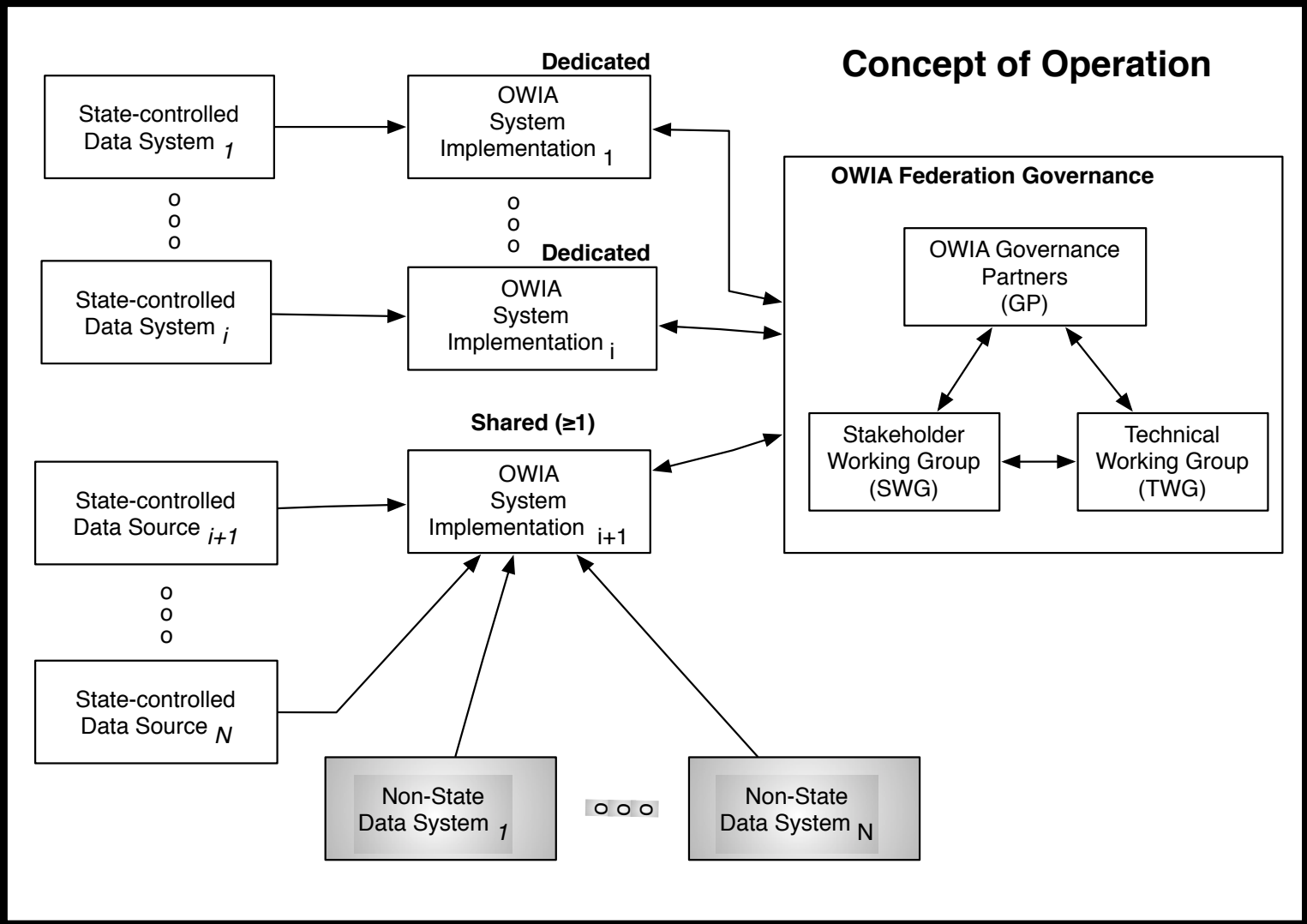
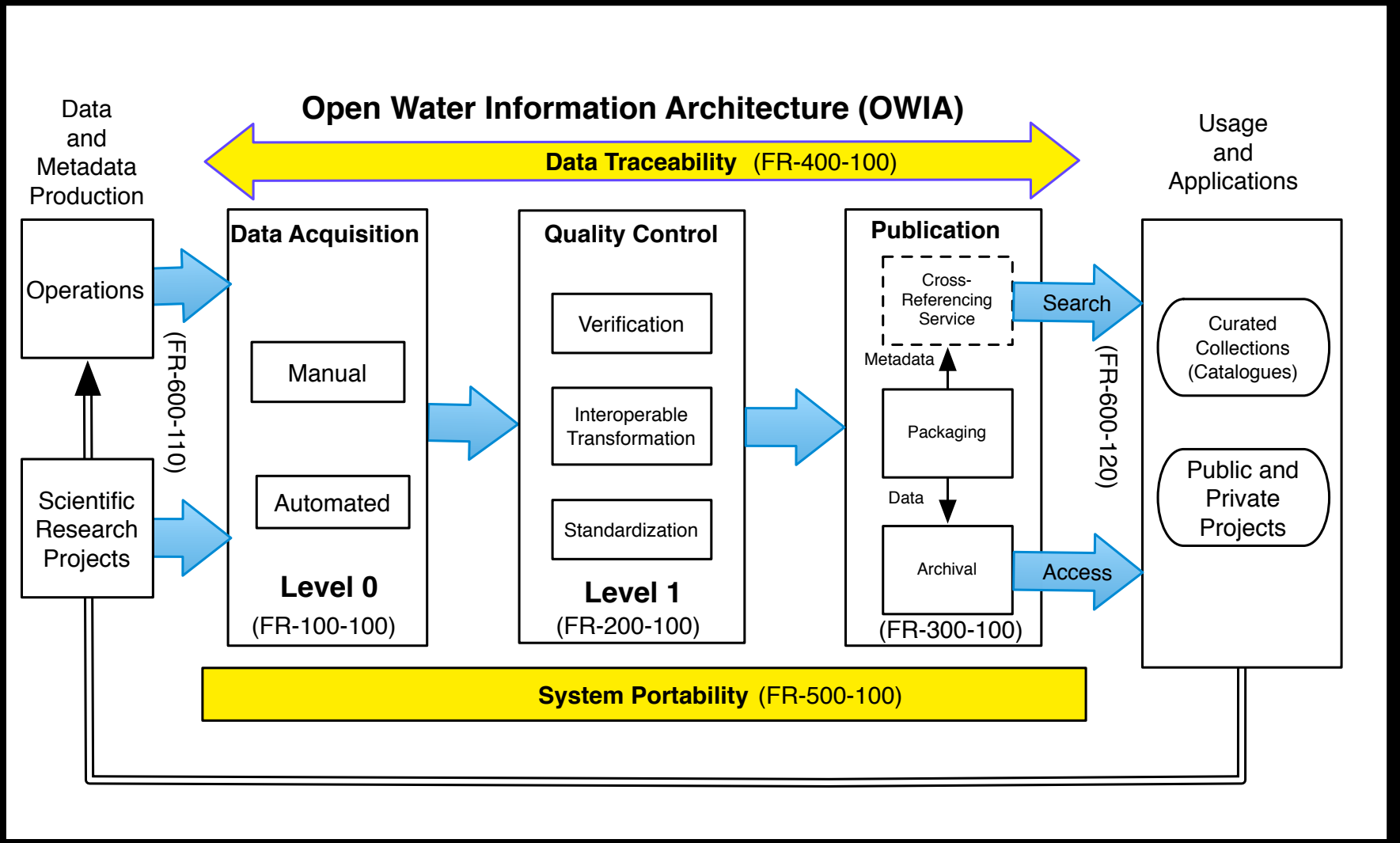
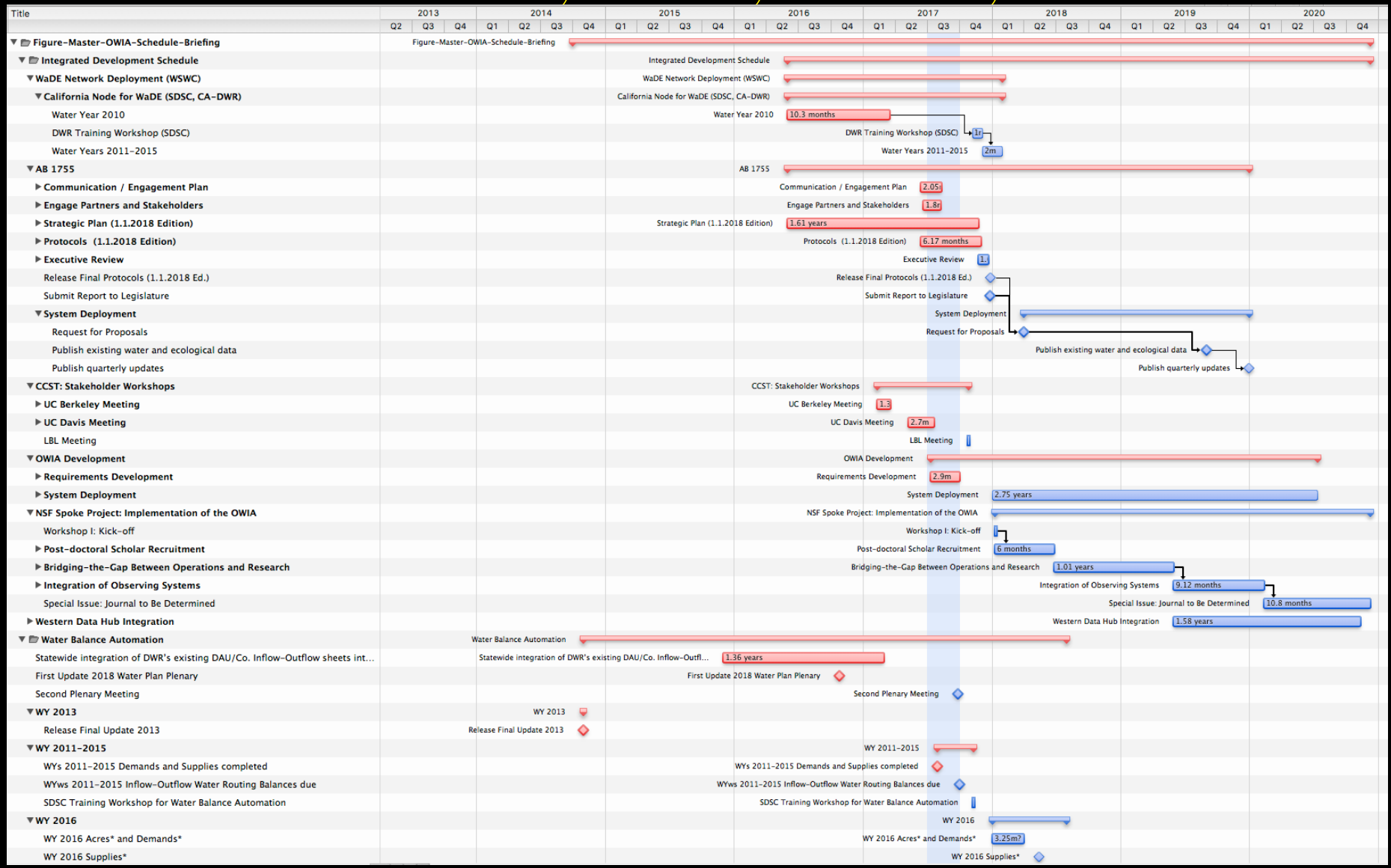
OWIA Concept of Operations



OWIA-Node Functional Components



OWIA Integrated Schedule
WaDE, CCST, AB1755, OWIA



Implementing the OWIA

Implementing the Open Water Information Architecture
Proposal to NSF

September 16, 2017

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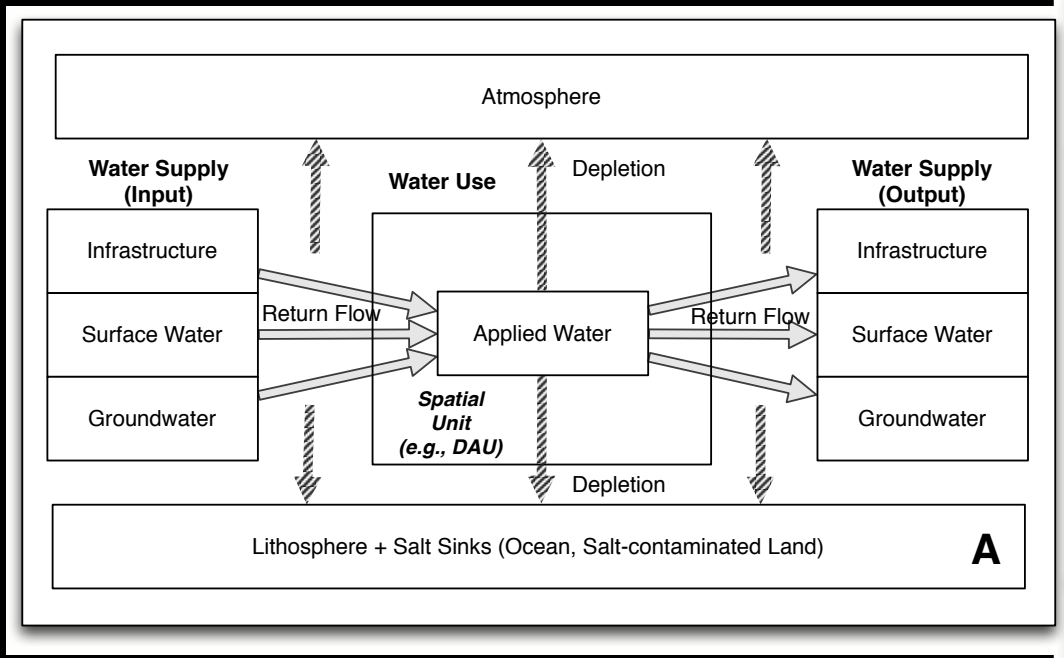
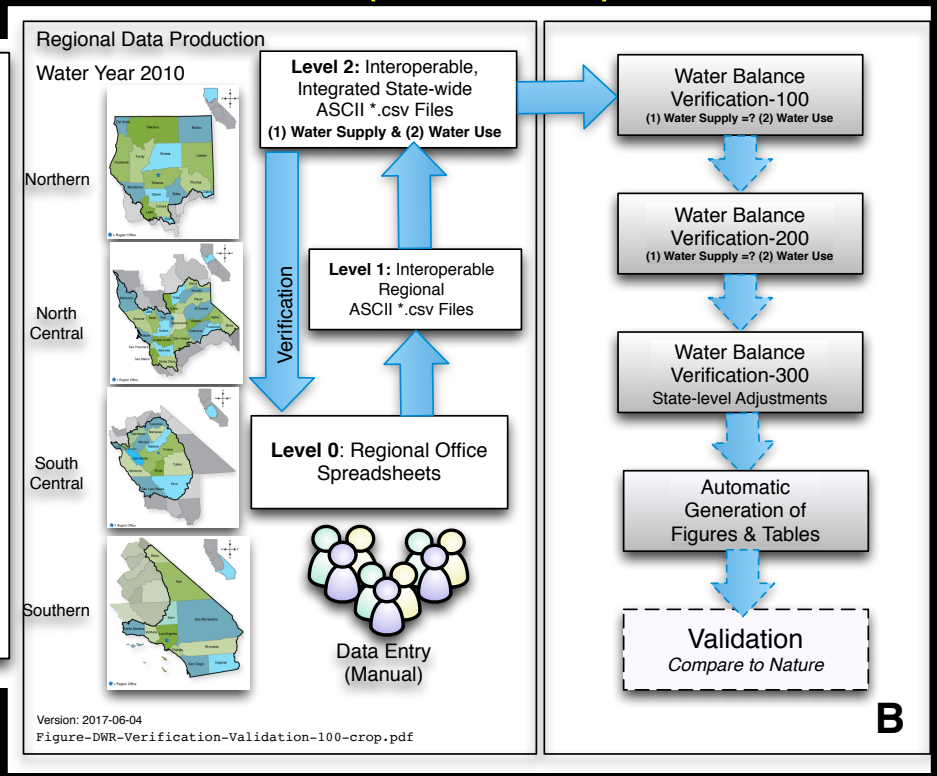
Water Balance Automation Methodology

Conceptual Model



Quality Control Procedure (Protocol)



Water Balance Automation Quality Control (Version 1.0)

- Transformation: From spreadsheets to interoperable (*.csv) form (Level 0 to Level 1), seperate Use and Supply, apply verification (Verification-000?)
- Standardization: applying controlled vocabulary to assure proper aggregation and tabulation; add georeferencing
- Verification Procedure (or Protocol):
  1. Verify Level 1 to Level 0: Checking for completeness, consistency, traceablility within hydrologic region, separating Use and Supply and assigning positive values to Supply and negative values to Use.
  2. Verify Level 2 Integration: Concatenate Level 1 files across hydrologic regions
  3. Verification-100: Checking for completeness, consistency, traceablility within hydrologic regions
  4. Verification-200: Checking for completeness, consistency, traceablility across hydrologic regions with tabulation at different spatial scales (i.e., DAU, Planning Area, Hydrologic Region, State)
  5. Verification-300: Re-factoring to Category B values (Environmental, Supply, Use) and verify State totals
- Validation: *under development*

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WY2010 Water Use
State-level Summary

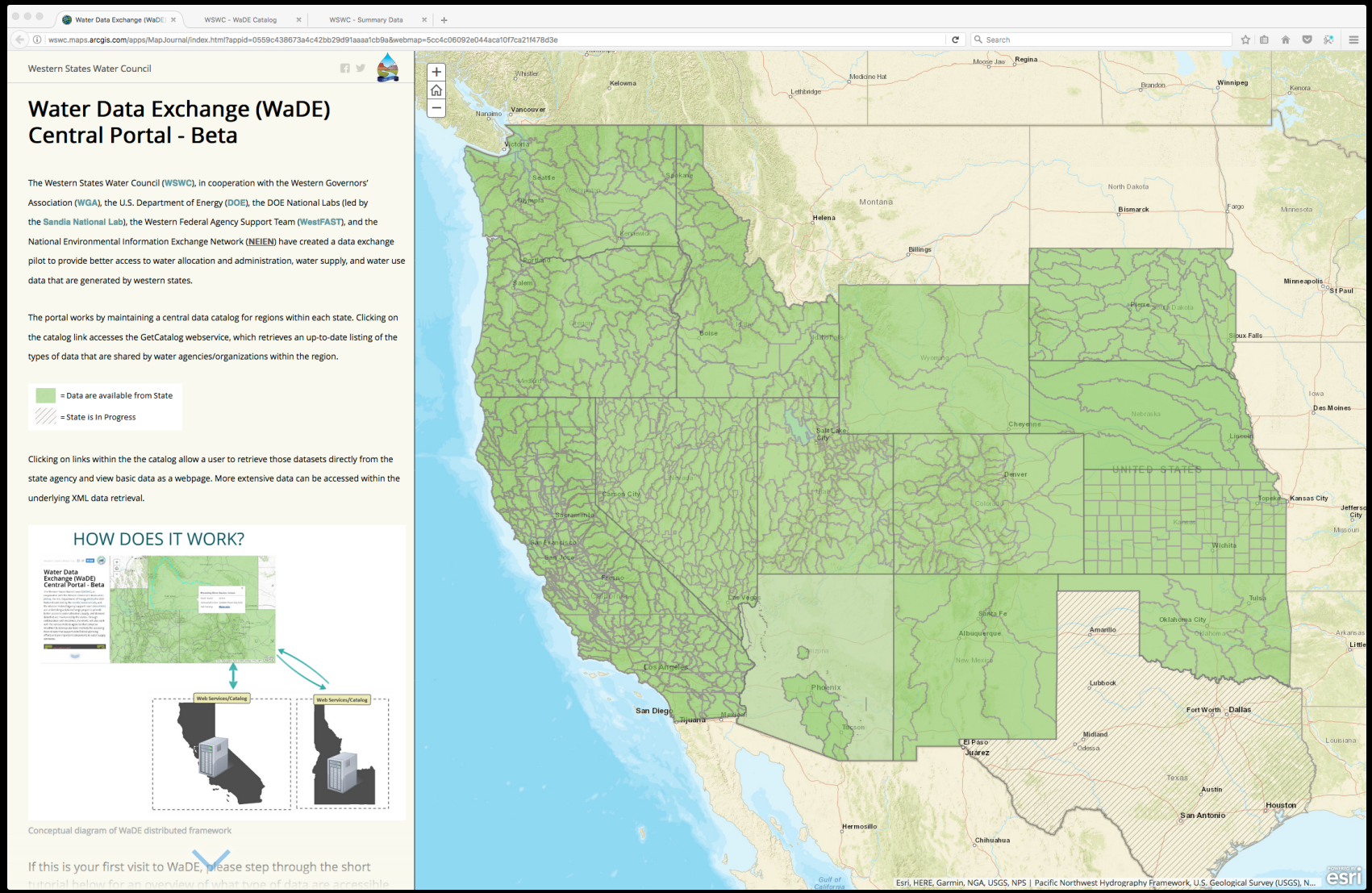
	CategoryB		
	Environmental KAcreFt	Supply KAcreFt	Use KAcreFt
CategoryA	sum	sum	sum
Agriculture	0	32268	−32448
InstreamFlowRequirements	6755	0	0
ManagedWetlands	0	1465	− 1473
RequiredDeltaOutflow	5323	0	0
Urban	0	8643	− 8413
WildScenicRiver	25061	0	0
All	37140	42376	−42335

WY2010 Water Use Hydrologic Region Summary

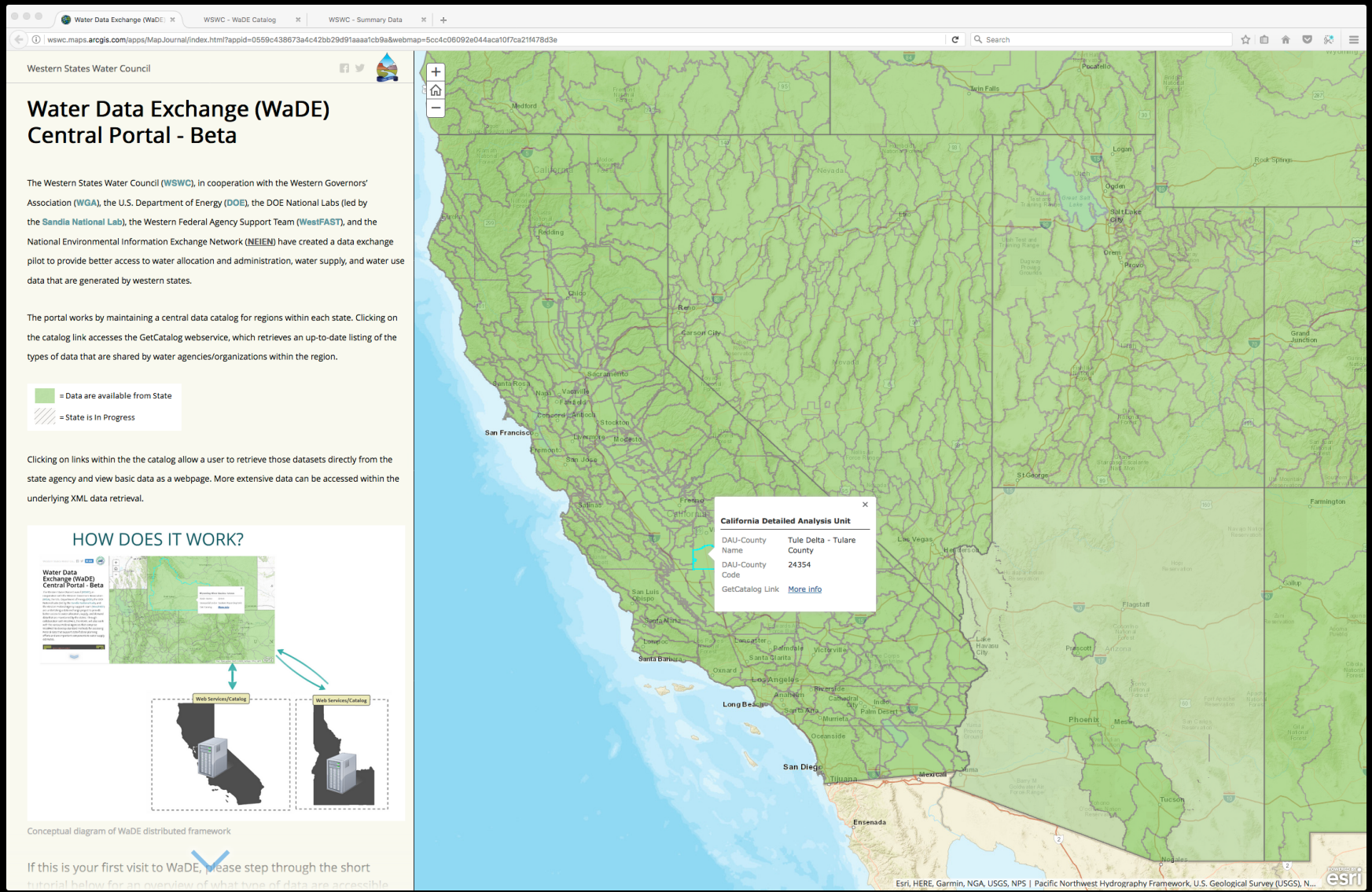
HRNAME	CategoryA	Environmental KAcreFt sum	CategoryB Supply KAcreFt sum	Use KAcreFt sum	All KAcreFt sum
Central Coast	Agriculture	0.0	824.1	−836.9	$-1.280e+01$
	InstreamFlowRequirements	25.3	0.0	0.0	$2.530e+01$
	ManagedWetlands	0.0	0.4	−0.4	$0.000e+00$
	RequiredDeltaOutflow	0.0	0.0	0.0	$0.000e+00$
	Urban	0.0	268.6	−256.6	$1.195e+01$
	WildScenicRiver	123.7	0.0	0.0	$1.237e+02$
Colorado River	Agriculture	0.0	3499.2	−3480.9	$1.830e+01$
	InstreamFlowRequirements	0.0	0.0	0.0	$0.000e+00$
	ManagedWetlands	0.0	30.3	−30.3	$0.000e+00$
	RequiredDeltaOutflow	0.0	0.0	0.0	$0.000e+00$
	Urban	0.0	605.6	−623.9	$-1.830e+01$
	WildScenicRiver	0.0	0.0	0.0	$0.000e+00$
North Coast	Agriculture	0.0	807.2	−820.0	$-1.280e+01$
	InstreamFlowRequirements	1800.6	0.0	0.0	$1.801e+03$
	ManagedWetlands	0.0	217.1	−224.8	$-7.700e+00$
	RequiredDeltaOutflow	0.0	0.0	0.0	$0.000e+00$
	Urban	0.0	179.4	−158.9	$2.050e+01$
	WildScenicRiver	17274.1	0.0	0.0	$1.727e+04$
North Lahontan	Agriculture	0.0	520.9	−523.5	$-2.600e+00$
	InstreamFlowRequirements	67.1	0.0	0.0	$6.710e+01$
	ManagedWetlands	0.0	26.9	−26.9	$-1.943e-16$
	RequiredDeltaOutflow	0.0	0.0	0.0	$0.000e+00$
	Urban	0.0	46.8	−44.2	$2.600e+00$
	WildScenicRiver	287.3	0.0	0.0	$2.873e+02$
Sacramento River	Agriculture	0.0	7902.4	−7910.3	$-7.900e+00$
	InstreamFlowRequirements	4117.0	0.0	0.0	$4.117e+03$
	ManagedWetlands	0.0	581.8	−578.8	$3.000e+00$
	RequiredDeltaOutflow	5323.4	0.0	0.0	$5.323e+03$
	Urban	0.0	1013.3	−1008.2	$5.100e+00$
	WildScenicRiver	3121.1	0.0	0.0	$3.121e+03$
San Francisco Bay	Agriculture	0.0	88.5	−97.9	$-9.400e+00$
	InstreamFlowRequirements	17.4	0.0	0.0	$1.740e+01$
	ManagedWetlands	0.0	0.9	−4.1	$-3.200e+00$
	RequiredDeltaOutflow	0.0	0.0	0.0	$0.000e+00$
	Urban	0.0	1155.1	−1142.5	$1.260e+01$
	WildScenicRiver	0.0	0.0	0.0	$0.000e+00$
San Joaquin River	Agriculture	0.0	7036.5	−7088.7	$-5.220e+01$
	InstreamFlowRequirements	644.3	0.0	0.0	$6.443e+02$
	ManagedWetlands	0.0	497.4	−497.5	$-1.000e-01$
	RequiredDeltaOutflow	0.0	0.0	0.0	$0.000e+00$
	Urban	0.0	742.5	−690.3	$5.220e+01$
	WildScenicRiver	2090.1	0.0	0.0	$2.090e+03$
South Coast	Agriculture	0.0	644.3	−644.6	$-3.000e-01$
	InstreamFlowRequirements	5.8	0.0	0.0	$5.800e+00$
	ManagedWetlands	0.0	32.3	−32.3	$0.000e+00$
	RequiredDeltaOutflow	0.0	0.0	0.0	$0.000e+00$
	Urban	0.0	3582.5	−3540.9	$4.160e+01$
	WildScenicRiver	104.4	0.0	0.0	$1.044e+02$
South Lahontan	Agriculture	0.0	370.5	−384.8	$-1.430e+01$
	InstreamFlowRequirements	77.7	0.0	0.0	$7.770e+01$
	ManagedWetlands	0.0	0.0	0.0	$0.000e+00$
	RequiredDeltaOutflow	0.0	0.0	0.0	$0.000e+00$
	Urban	0.0	294.6	−280.3	$1.430e+01$
	WildScenicRiver	43.5	0.0	0.0	$4.350e+01$
Tulare Lake	Agriculture	0.0	10574.4	−10660.8	$-8.640e+01$
	InstreamFlowRequirements	0.0	0.0	0.0	$0.000e+00$
	ManagedWetlands	0.0	77.7	−77.6	$1.000e-01$
	RequiredDeltaOutflow	0.0	0.0	0.0	$0.000e+00$
	Urban	0.0	754.3	−667.6	$8.670e+01$
	WildScenicRiver	2016.7	0.0	0.0	$2.017e+03$
	All	37139.5	42375.5	−42334.6	$3.718e+04$

Table 2: 2010 water year data by **Hydrologic Region**.

WaDE Interoperability: Western States Regionalization



WaDE Interoperability: Select DAU



WaDE Interoperability: DAU Detail

About WaDE | Back to WaDE By Map | Back to WaDE by DataType

Western States Water Council

Water Data Exchange (WaDE) Summary Data

NOTICE For all data provided, please review the associated methodology information thoroughly to discover data provenance and quality before using, especially when comparing data between states, organizations or applications.

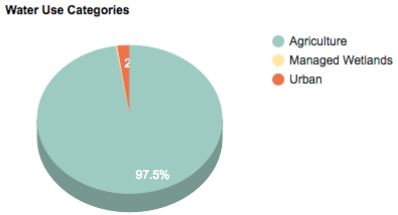
Organization: California Department of Water Resources

Location Information: DAU24354 - Detailed Analysis Unit and County - DAU24354

This summary is relevant for the reporting year: 2010 - Water

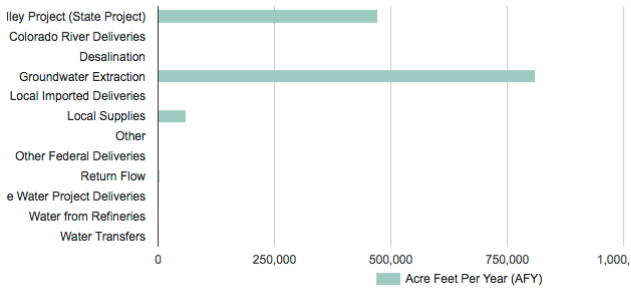
These data were reported on: 2017-05-30

Water Use Summary



Beneficial Use	Consumptive Use?	Fresh/Saline	Source Type	Irrigation Type	Acres Irrigated	Crop Type	Population Served	Power Generated (MWH)	Acre-Feet Per Year (AFY)
Agriculture	1	FRESH	TOTAL		NaN	-999	-999		1,311,300
Managed Wetlands	1	FRESH	TOTAL		NaN	-999	-999		3,300
Required Delta Outflow	1	FRESH	TOTAL		NaN	-999	-999		0
Urban	1	FRESH	TOTAL		NaN	-999	-999		30,600

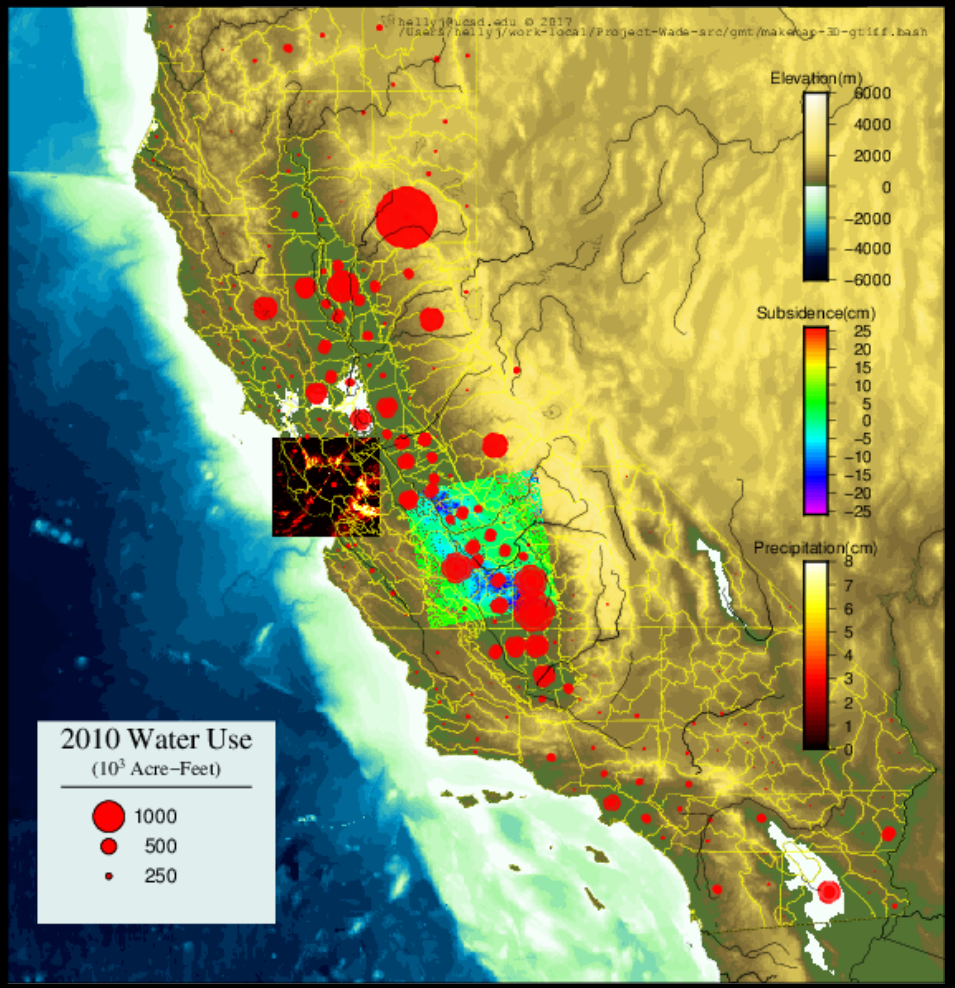
Estimated Water Supply Summary



Supply Type	Acre-Feet Per Year (AFY)	GIS Feature	Water Supply Methodology
Central Valley Project (State Project)	471,600	DAU24354	CA DWR Hydrologic Analysis (hellyj@ucsd.edu)
Colorado River Deliveries	0	DAU24354	CA DWR Hydrologic Analysis (hellyj@ucsd.edu)
Desalination	0	DAU24354	CA DWR Hydrologic Analysis (hellyj@ucsd.edu)
Groundwater Extraction	810,400	DAU24354	CA DWR Hydrologic Analysis (hellyj@ucsd.edu)
Local Imported Deliveries	0	DAU24354	CA DWR Hydrologic Analysis (hellyj@ucsd.edu)
Local Supplies	60,600	DAU24354	CA DWR Hydrologic Analysis (hellyj@ucsd.edu)
Other	0	DAU24354	CA DWR Hydrologic Analysis (hellyj@ucsd.edu)
Other Federal Deliveries	0	DAU24354	CA DWR Hydrologic Analysis (hellyj@ucsd.edu)
Return Flow	2,800	DAU24354	CA DWR Hydrologic Analysis (hellyj@ucsd.edu)
State Water Project Deliveries	0	DAU24354	CA DWR Hydrologic Analysis (hellyj@ucsd.edu)
Water from Refineries	0	DAU24354	CA DWR Hydrologic Analysis (hellyj@ucsd.edu)
Water Transfers	0	DAU24354	CA DWR Hydrologic Analysis (hellyj@ucsd.edu)

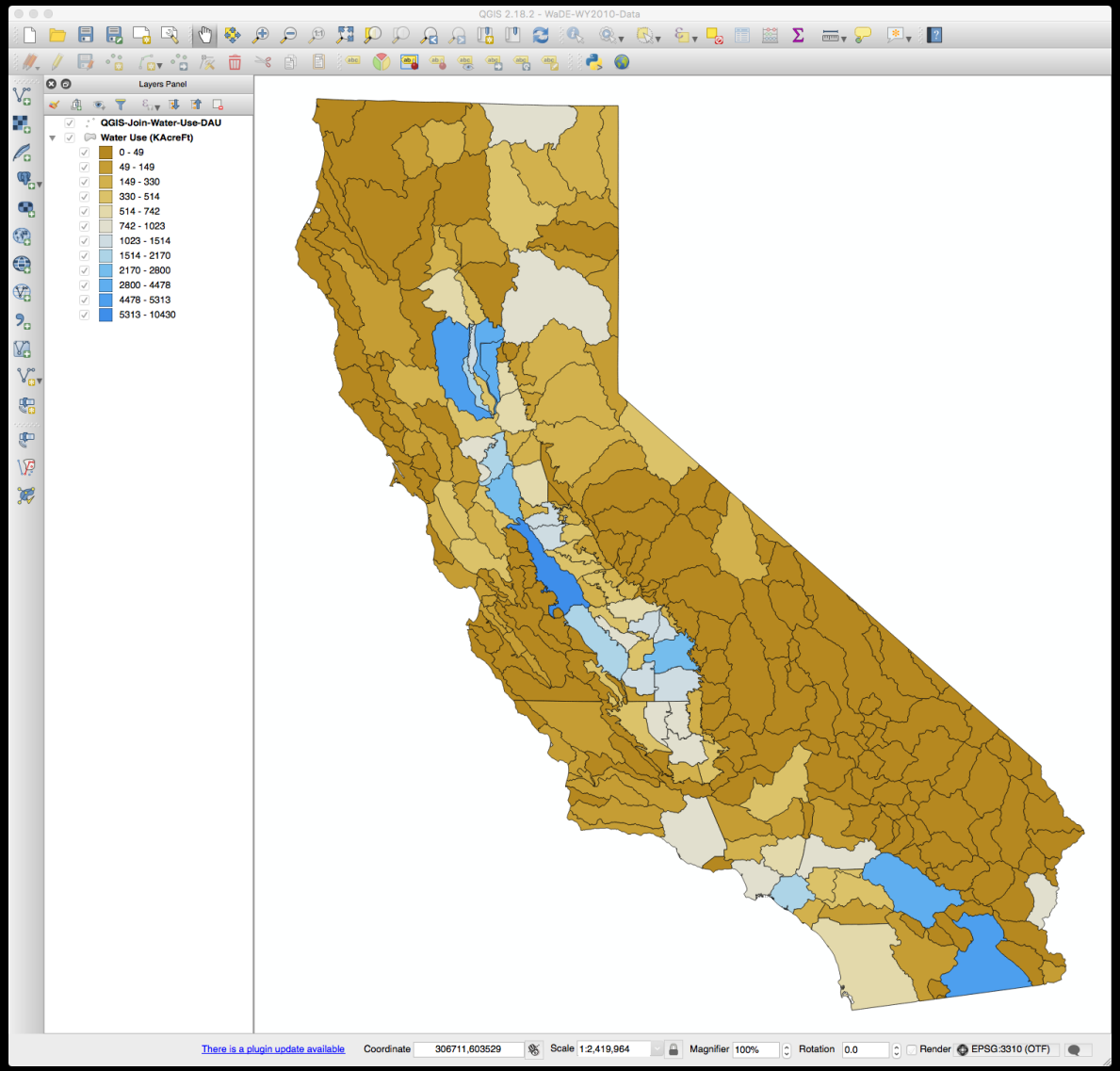
Multi-Source Data Integration Example

Using An OWIA Approach: Example of scriptable mapping capabilities



- **Six (6) data sources** converted to OWIA Level 1 integrated in this image.
  1. Smith and Sandwell Global Topography
  2. DAU polygons from CA-DWR,
  3. InSAR data (courtesy of NASA JPL),
  4. CA-DWR water use data for WY2010,
  5. West-WRF modeled atmospheric river quantitative precipitation forecast (small image south of San Francisco Bay)
  6. National Hydrography data (inland water bodies).
- Map produced using GMT5

Georeferenced WY2010 Water Use GIS Application Example



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Summary

1. Water Balance Automation is the first case-study of how to apply OWIA concepts and principles
2. WY 2010 completed using this method and verified against Water Plan 2013
3. Interoperability across systems demonstrated using WaDE
4. Integrated schedule is being used to coordinate activities
5. Training workshop planned for Nov 2017 at SDSC contingent on data availability
6. OWIA System Requirements Document being updated after public comment period
7. Moving ahead with OWIA Implementation Plan to meet AB1755 schedule